JASPER FIRE
RAPID ASSESSMENT

BLACK HILLS NATIONAL FOREST
SEPTEMBER 2000

CHAPTER ONE

Overview

INTRODUCTION

The Jasper wildfire of August and September 2000 was the largest fire in the recorded history of the Black Hills. Its effects will be both widespread and long-term. This Rapid Assessment document summarizes the fire's effects and recommends guidelines for future actions.

The fire ignited on August 24, 2000, near Custer, South Dakota, and is believed to have been human-caused. The fire spread rapidly and overpowered suppression efforts. On the afternoon of August 26, 2000, the fire exploded, growing at an average rate of more than 100 acres per minute. The fire was officially contained on September 8, 2000, after burning 83,508 acres.

This assessment was developed by a team of interdisciplinary specialists. The team considered only those lands within the fire perimeter that are administered by the Black Hills National Forest (79,404 acres). This assessment does not address effects on the approximately 2,825 acres of private land or the 1,279 acres administered by Jewel Cave National Monument.

The purpose of this document is to:

- Provide an assessment of the fire's effects on the landscape.
- Provide a context for future actions that may be taken to address the fire's effects and reach desired conditions.
- Facilitate program and budget development by recommending priorities for needed management actions.
- Suggest general guidelines to protect and maintain physical and biological resources.
- Recommend monitoring strategies and research opportunities.

Area Setting

The fire area lies between Custer, South Dakota, and Newcastle, Wyoming, in an area locally known as the Limestone Plateau *(see Figure 1)*. The fire perimeter takes in approximately 83,508 acres, or about 7 percent of the Black Hills National Forest. The landscape is dominated by gently dipping plateau ridges that are dissected by steep, rocky canyons and moderately sloping valleys. Soils are well-drained and generally stable. Precipitation averages around 20 inches per year, most of which falls as rain from high-intensity storms in spring and early summer. Stream flow is seasonally nonexistent. Vegetation consists of extensive stands of ponderosa pine with inclusions of hardwoods and spruce, interspersed with grassy meadows. The area supports a variety of wildlife species. Human uses include recreation, firewood cutting, cattle grazing, and logging. Residences are scattered on private land. An extensive road system provides access.

Management Direction

The Black Hills National Forest Land and Resource Management Plan, revised in 1997, provides guidance for all resource management activities on the forest. Known as the Forest Plan, it establishes goals, objectives, standards, and guidelines, and specifies management emphasis for each area of the forest. The Jasper Fire affects Management Areas 5.1 - resource production emphasis and 5.4 - big game winter range emphasis *(Figure 2)*. Designated late successional timber stands are scattered throughout these these two management areas. Management direction for these stands is provided by Objective 207(b), revised Forest Plan.

In October, 1999, the Deputy Chief of the Forest Service issued a decision on several appeals of the 1997 Revised Forest Plan. The Deputy Chief upheld the Regional Forester's decision on most points, but indicated that protections for certain plant and wildlife species were inadequate and needed improvement. A subsequent lawsuit indirectly challenged application of these Forest Plan protections to a number of project decisions made since 1997 under the Revised Plan. Specific issues in the lawsuit included the northern goshawk, snag-dependent birds, a variety of other species, and Research Natural Areas. A settlement agreement addressing these issues has been negotiated and was filed with the Court. This settlement agreement will impose changes on four active timber sales lying wholly or partly within the fire perimeter, and prohibit certain management activities within parts of the sale areas for several years. These sales occupy over 30,000 acres, or about 36 percent of the total area within the fire perimeter. Additionally, the agreement directs that new project decisions across the forest will be consistent with the terms of a future Forest Plan amendment that will address the deficiencies identified in the Chief's appeal decision.

Assessment Process

This assessment was prepared using tabular and spatial databases, environmental analyses, and other information previously collected by the Black Hills National Forest. It includes information from the Jasper Fire Burned Area Emergency Rehabilitation (BAER) Report and supporting specialist reports. The Assessment Team, along with support specialists within both the Forest Service and other State and Federal agencies, conducted field observations and analyses for this assessment. Of particular value was satellite imagery provided by the Earth Resources Observation Systems (EROS) Data Center in Sioux Falls, South Dakota. This satellite imagery, collected on September 5, 2000, allowed the Team to rapidly map fire intensity throughout the fire area. This intensity mapping was the most critical data needed for this assessment.

The satellite image was in the form of spectral data. Differing fire intensities were classified by their reflectance. Ground measurement plots were used to refine this spectral image classification. No statistical estimate of accuracy for the fire intensity classification is available at this time, but field verification indicates it is accurate for the purpose of providing an overall assessment of the fire area.

Much of the data presented in this assessment was extrapolated from fire intensity mapping. Models were developed from field observations to predict the fire's effect on these resources. These models utilized existing Geographic Information System (GIS) and other databases as a baseline data source. Field observations and site sampling were used to estimate effects of different fire intensities. Site locations were determined using global positioning system (GPS) electronic survey equipment, where precise location data was desired. GIS was then used to overlay the fire intensity mapping on various resource coverages to determine effects. For example, known goshawk nest sites were overlain using GIS on the fire intensity classification map. Where high fire intensities overlapped with goshawk nest locations, it was assumed that the nest was destroyed by the fire. Conversely, where low fire intensities overlapped known goshawk nest sites, it was assumed the nest was not damaged. These assumptions were then tested in the field and determined to be accurate. Using the models and state-of-the-art technology, the Assessment Team could rapidly gather information and estimate resource and other effects.

JASPER FIRE SUMMARY

The Jasper Fire started at about 2:30 p.m. on August 24, 2000. The weather was very hot and dry, vegetation moisture was at record low levels, and atmospheric conditions were very unstable. These conditions caused extreme fire behavior, and the fire spread rapidly. Almost immediately after ignition the fire spread into the tops of the trees, and blowing embers began causing spot fires ahead of the main fire.

On the first day, the fire doubled in size every hour. It spread at an average rate of over 7 acres (about 7 football fields) per minute, consuming 3,655 acres by the end of the day. Fueled by unstable weather conditions, the fire continued to grow during both the day and night of the 25th. On the third day, strong winds and extreme conditions caused the fire to grow by 48,555 acres, or 76 square miles, in the space of only a few hours. Fire behavior moderated on subsequent days; however, fuel moisture remained extremely low, and the fire grew by another 23,000 acres before containment on September 8. The fire's final size was 83,508 acres, the largest fire in the recorded history of the Black Hills.

The fire completely blackened some areas, leaving scorched, dead trees and ash-covered ground in its wake. Other areas experienced only a light ground burn, with just the base of the tree trunks and lower branches slightly burned or browned. Large areas within the fire perimeter remain green, either lightly burned or completely unburned. The overall burn area exhibits a mosaic pattern typical of many wildland fires.

Firefighters were highly successful in protecting lives and property. Despite the dangers posed by fire, thick smoke, rough terrain, and unstable root-burned trees, there were no injuries or fatalities. In addition, many homes and other structures were saved.

CHAPTER TWO

Resource Conditions

WATER

The dominant hydrologic characteristics of the Jasper Fire area are determined by the underlying geology. Generally the east side of the fire is in the Madison Limestone, while the west side is in the Minnelusa Formation consisting of sandstones and dolomites. Because of the highly permeable nature of these materials, streambeds are often vegetated and do not display a defined bed. This part of the Black Hills is generally a groundwater recharge area.

Stream flow within the Jasper Fire is almost nonexistent and is very dependent on precipitation. Short sections of some streams, such as Bear Springs Creek, flow at times. In these areas, water surfaces when it encounters a hard rock layer, flows a short distance, and disappears again at a ground water recharge zone. These streams are scattered throughout the fire area.

Peak flows generally occur during rainfall events. If the rainfall exceeds the infiltration rate, the water is available for runoff. If enough runoff is available, streamflow or flooding is possible. However, if precipitation falls gradually, stream flow will not occur.

How the fire will affect streamflow depends mainly on precipitation - in what form it comes, and at what intensity. If precipitation comes gradually as rain or snow, major effects are unlikely. If large amounts of rain fall in a short period of time, floods will occur. Streamflow could be increased or appear in new locations due to reduced evapotranspiration by trees. For the same reason, springs may appear where they have not been observed in the past. Caves could also be affected. Water will not flow in the caves, but they may become more damp.

Yearly precipitation at the nearest weather stations averages about 20 inches. The fire area is generally higher than these weather stations and can be expected to receive more precipitation. Furthermore, the northern part of the fire generally receives more precipitation than the south. Approximately 50% of the precipitation comes during May, June, and July, with 75% occurring in the five-month period of April through August.

Water quality is not an issue in this area, since streams generally do not flow except during precipitation events. However, during these events, sediments stored in channels can be mobilized and carried downstream.

Watersheds affected by the fire

The fire affected parts of eight Hydrologic Unit Code (HUC) 6 watersheds. HUC 6 watersheds are generally 10,000 to 40,000 acres in size. Six of the watersheds have less than 20% of their acreage in the fire area. Major portions of the remaining two watersheds are in the fire area. Eighty-seven percent of Upper Hell Canyon watershed is within the fire area, as is 64% of Gillette Canyon watershed. All of the watersheds, except South Fork Castle Creek, are tributary to the Cheyenne River and Angostura Reservoir.

Upper Hell Canyon is a headwaters watershed (no water flows into it other than rainfall and springflow, and all the water flowing out is generated in the watershed). It contains five HUC 7 watersheds, which are generally between 5,000 and 10,000 acres in size. Three of the HUC 7 watersheds - Upper West Hell Canyon, Lower West Hell Canyon, and Lithograph Canyon - are entirely within the fire area. All five of the HUC 7 watersheds will need special consideration during post-fire activities *(see Chapter 3 - Recommendations)*.

Gillette Canyon is also a headwaters watershed. It consists of seven HUC 7 watersheds. All but one are more than 50% within the fire perimeter. These six watersheds will also need special consideration during post-fire activities.

Other HUC 7 watersheds that are over 35% within the fire perimeter include Water Draw, Upper Tepee Canyon, Middle Redbird Canyon, and Lower Redbird Canyon. The same recommendations apply to these watersheds.

SOILS

General Current Condition Following the Jasper Fire

Following the Jasper Fire, a Burned Area Emergency Rehabilitation (BAER) team determined that the fire did not result in an emergency regarding potential loss of soil productivity. The BAER team did not identify a need for soil productivity rehabilitation.

The BAER report did indicate that soil cover was affected. The team estimated that if, on average, an area had 30% bare ground under unburned conditions, under moderate burn intensities there would be 60% bare ground and under high intensities there would be 90% bare ground. Field reviews have borne out this estimation, and shown that where a duff layer is still present, it is typically not more than ¼” thick. Because of these conditions, measures to retain the productivity of burned sites will probably need to be taken before ground-disturbing activies resume.

Erosion Hazard

The rate and scale of erosion in the Black Hills depends on local geology, topography, vegetation, and climate. Fires and fire management activities also have the potential to increase erosion. An increase in erosion that accelerates removal of topsoil and associated organic matter can cause long-term loss of productivity.

The rates of erosion and recovery following a fire also are affected by burn severity, vegetation recovery, and weather patterns. Much of the sediment loss can occur the first year after a fire. In ponderosa pine, sediment loads resulting from erosion after a low-severity fire may return to normal levels within 3 years, but moderately and severely burned watersheds often take longer to recover. Nearly all fires increase erosion and sediment yield, but wildfires in steep terrain tend to produce the greatest increase. Whatever the terrain, erosion following a fire can be low in the absence of major rainfall events. However, erosion can be high in steep terrain after high-intensity rainstorms.

Ground vegetation and litter help stabilize soil. In many areas, the fire consumed the ground cover necessary to protect against soil erosion. Assuming little further disturbance, however, the litter layer will immediately begin to build up again as a result of vegetation growth and the fall of dead needles, limbs, and trees. Within 2 to 5 years, amounts of coarse woody debris and understory vegetation will probably return to normal. This will return erosion rates to pre-fire conditions.

Fire suppression dozer lines are another area of erosion concern, especially on steeper slopes. Teams are already working to rehabilitate dozer lines by constructing water bars and pulling soil berms and slash back onto the firelines. Seeding will also take place. However, dozers usually remove vegetative crowns. It will be important that these areas be given enough time for vegetation to develop adequate root masses and above-ground biomass to protect against disturbances that could result in further erosion. Examples of such disturbances include cattle grazing and trampling before a litter layer has developed, and motorized traffic due to increased accessibility.

Potential accessibility in the overall fire area has increased greatly. The fire removed trees and shrubs that protected soils from motorized vehicle traffic. If this type of use now occurs on burned, unvegetated slopes, increased erosion could result. Roads that, before the fire, may have been impassible or closed may now be used in the condition that they are in, which could also increase erosion and watershed problems. It will likely take at least three years to return the moderately and intensively burned areas to pre-fire erosional conditions.

Nutrient Release and Removal

Trees, ground vegetation, and ground debris, including heavy fuels, all were burned where the fire burned at moderate or high intensity. This resulted in a "quick release" of nutrients into the soil. Dead standing trees and roots will slowly release nutrients over time. Decaying down woody debris will not only provide nutrients but will host microorganisms, which play an important role in the uptake of nutrients and water by woody plants.

Mass Movement Potential

Where steeper slopes burned at high intensity and consumed root masses, the potential for mass movement has increased. Little mass movement is expected to occur.

Soil Compaction

Soil compaction is caused when excess weight is placed on the soil, as by vehicles or large animals. Compaction impairs infiltration, root growth, and soil biota, increasing runoff and the associated effects of increased erosion. Soil map units SyaC, SybC and SycE within the Jasper fire perimeter are composed of soils that are susceptible to compaction when the soils are wet *(Figure 3)*.

Reforestation Potential

Foresters consider soil interpretations when determining forest land suitability. These interpretations are used to predict soil response to various activities. The ratings assume the soils are in their natural condition and do not consider current uses, accessibility, or other factors related to forest land use. The assessment team used soil interpretations to estimate the potential for successful natural tree regeneration and tree planting on soil types in the fire area.

Natural tree regeneration could be impeded on some sites by seedling mortality, plant competition, and other factors. In the Black Hills, competition with other vegetation is one of the major factors that can prevent successful restocking. Some of the soil types in the Jasper Fire area are rated "moderate" for vegetative competition with ponderosa pine, and natural regeneration in the burned area may be hindered by this competition. Other problems include the lack of nearby seed trees in the more heavily burned areas, and the possibility of low seed production years and drought conditions.

Successful regeneration will also depend on moisture retention. Soils will dry faster where the canopy, litter, and down woody debris were consumed by the fire. This increases the potential for seedling mortality. Leaving down woody debris on site would help retain soil moisture and reduce competition from grass.

Within the fire area, the soil map units with the highest potential for natural tree regeneration include CkC, SyaC, SybC, and SycE *(Figure 4)*. These soil units total 31,153 acres, or 37% of the fire area. However, these same soil types have a high available water capacity, which benefits competing vegetation as well as tree seedlings and may affect seedling establishment.

Seedling mortality ratings are probably the best available prediction of hand **tree planting** success. Seedling mortality refers to the probability of survival of naturally occurring or planted tree seedlings, as influenced by soil type and topographic conditions. The primary causes of seedling mortality are too much or too little water. Excessive soil wetness is caused by a seasonally high water table or flooding during a substantial part of the growing season. Soil droughtiness can be caused by available water holding capacity, shallow rooting depth, or high evaporation rates. The soil map units with the lowest potential for seedling motality are CkC, SyaC, SybC, and SycE *(Figure 4)*, again totalling 37% of the fire area. These areas also have the highest site indices within the fire perimeter. Planting can occur on other soil map units, but measures such as using special planting stock, bedding, planting on north-facing slopes, etc., may be needed to offset the seedling mortality hazard.

Certain soil map units in the Jasper Fire area formed under grass . Some stringers and patches of pine occur in these units, but in general pine will not do well and should not be planted.

RANGE

The fire directly affected 11 grazing allotments and 24 grazing permits *(Figure 5)*. Range structural improvements that were damaged include:

- 150 miles of fence
- 65 stock tanks
- 6 wells
- 20 miles of water pipeline

Estimated costs of repair include $990,000 for fences, $130,000 for water developments, and $110,000 for pipelines. Remaining fences and water developments could be damaged when fire-killed trees begin to fall.

Range vegetation was affected to varying degrees, depending on fire intensity. In areas of high intensity, most vegetation (including grasses, forbs, and shrubs) was consumed, right down to and in some cases including the duff layer. This was true in meadows and open parks as well as on the ridges. In areas of moderate intensity some residual stubble and litter exist, and vegetation is already beginning to grow again. Areas of low fire intensity are resprouting, and sufficient litter is in place to provide adequate ground cover. Meadows and parks also exist as unburned islands. These meadows evolved under the influence of fire, and the plants will recover quickly given the right moisture conditions. In general, remaining vegetation is not adequate to continue livestock grazing at this time.

There are currently no livestock within the fire perimeter except for small groups of cattle that have been able to wander into the black due to fire-related fence damage. These cattle will probably not stay in the area, since they will find little forage or water. The majority of the cows permitted within the fire perimeter were removed from the allotments during the fire. The remainder were rounded up and removed when the fire situation eased.

Invasion or spread of noxious weeds is a concern in areas where: 1) fire consumed the litter layer, 2) the overstory has been burned away and no longer provides shade, and 3) the ground was disturbed during suppression efforts. These areas are generally the blackest parts of the fire or where people and equipment worked. Forbs and grasses have been decreased in these areas, leaving the ground vulnerable to noxious weeds.

VEGETATION

Tree Mortality and Affected Volume

A detailed survey of post-fire stand conditions in the burn area has not been completed. Lacking that data, fire intensity was estimated for this assessment. The assessment team made the estimations by interpreting LANDSAT data with the following definitions *(Figure 6):*

- High-intensity burn (39% of fire area): trees are devoid of needles
- Moderate-intensity burn (32%): crowns are entirely or almost entirely scorched
- Low-intensity burn (24%): trees are all or partially green

Low intensity may include some unburned areas. The remaining 5% of the area was unclassified due to cloud cover and other factors. Photo examples of burn intensity are shown on the following page.

The assessment team estimated tree mortality based directly on fire intensity. It was assumed that tree mortality will be 100% in the high-intensity burn areas and other areas where more than 50% of the crown was scorched. The trees with partial crown scorch were most likely already under stress from below-average moisture conditions; this will probably have a direct effect on their survival. Based on ocular estimation, the overall mortality in low-intensity burn areas was assumed to be 20%.

Timber volume affected by the fire was calculated using these estimated figures and pre-burn stand data. The figures include all stands regardless of suitability, operability, access, or other constraints. In practice, the amount of timber volume actually available for harvest or salvage would undoubtedly be lower.

In the burn area, the following approximate volume of wood existed, before the fire, in trees greater than 9” in diameter:

- High-intensity burn areas: 123,469,780 board feet
- Moderate-intensity burn areas: 99,875,077 board feet
- Low-intensity burn areas: 81,728,552 board feet
- Unclassified intensity: 14,018,574 board feet
- Total: 331,438,963 board feet

Timber Sales

Five sold timber sales lie all or partly within the fire area. These are Dumbuk, Crooked/Uncle, Lemming, Crawford, and Limestone sales *(Figure 6)*. The fire affected timber harvest unit boundary and individual tree markings according to fire intensity.

Trees in areas of high fire intensity are, in general, completely black. These areas sustained 100% mortality, and paint markings on trees are no longer visible. Trees in areas of moderate fire intensity have completely scorched, brown foliage. Tree boles are black to varying heights. These areas also sustained close to 100% mortality. Sale unit boundary and individual tree markings are visible only in random areas and are difficult to locate consistently. Where the fire burned at low intensity, green needles remain on the trees. Many trees may still die due to excessive crown scorch or bole damage. Seedlings and saplings were often damaged or killed by the fire. About 70% of the paint markings on trees remain visible, but stump marks may have been burned or obscured.

Foresters will need to assess the status of all harvest units and boundaries and determine whether re-marking is necessary. Timber volume cruises and appraisals are no longer valid for cutting units or timber sales as a whole. Aside from the occasional fallen tree, timber sale roads are in good condition. Ash and bare soils may cause road drainage features to need more frequent maintenance.

Recovery of timber value may be possible in some areas. Timeframes and requirements for environmental documentation will vary by whether the timber is located within existing harvest units, outside harvest units but inside sale area boundaries, or outside sale areas *(Figure 7)*. Timber sale contracts provide for inclusion of damaged timber following a fire, depending on the volume of damaged timber available. Before the contract is modified, the sale is re-appraised to determine the timber's value.

Timber quality and suitability vary across the fire area. Many stands consist of saplings, poles, and small sawtimber. The saplings and poles are unlikely to have economic value in terms of timber recovery, since burned trees are generally not suitable for chip products. The fire also reduced the value of sawtimber, since there is less demand for fire-killed timber than for green standing timber. Due to factors such as blue stain fungus and wood boring beetles, the value of the timber will start to decrease almost immediately. The value will continue to decrease over the next one to two years until recovery is no longer economically viable. Preliminary estimates are that the affected sales contain a total of about 80 million board feet in areas that burned at moderate to high intensity *(Figures 8 and 9)*. This figure is based on pre-fire inventories and does not take into account any harvest constraints.

The fire may make harvest operations more difficult. Worker safety could be threatened by fire-killed trees that can fall at any time. Ash and dust will be hazardous to human health and will cause machinery both in the field and at the processing plant to need additional maintenance. Soils in some areas may need protection.

Natural Conifer Regeneration

It is reasonable to expect some natural regeneration of ponderosa pine in areas of the fire that are close to living seed sources. Pine seeds have been observed on the forest floor since the fire, and appear to have come from trees that are now dead. Foresters have taken a scattering of 1/300th acre plots to estimate seedfall density. Results ranged from 0 to 22 seeds per plot; however, there was no statistical design to the survey, so no inference can be made about seed distribution across the fire. The pine seeds appear to be mature. Germination tests are the best indicator of maturity, but were not possible due to the short time frame of this assessment. Germination tests will be conducted over the winter.

Based on the presence of seed in the burned area, some regeneration can be expected next spring. Success of natural regeneration will be affected by seed maturity, winter and spring precipitation, foraging by wildlife, and soil surface temperatures after germination. Regeneration in these areas will be monitored.

Areas of complete mortality that are far removed from a viable seed source could take as long as 200 years to regenerate. More on estimated probability of regeneration success is found in the Soils section at the beginning of this chapter.

Hardwoods

Aspen *(Populus tremuloides)* is the primary hardwood tree species affected by the fire. Forest databases show 467 acres of aspen cover type within the fire perimeter prior to the fire. Effects of the fire varied, ranging from no effect to a severe burn. Photos illustrating each of these conditions can be found in Appendix B. Post-fire stand conditions and an estimate of the percentage of the total aspen area are as follows:

- No impact (5%). There was no fire in the stand and it remains in its pre-fire condition.
- Light impact (25%). These stands sustained a low-intensity patchy ground fire. At this time, the overstory trees appear to be unaffected by the fire, but many seedling-size suckers are burned and have no leaves remaining.
- Moderate impact (50%). The leaves in these stands are wilted and brown in both the overstory and understory. Some of these stands sustained low-intensity ground fires and others did not. Those that did not were probably damaged by the hot gases from crown fires in adjacent pine stands rather than by direct flame contact.
- Heavy impact (20%). These stands may have sustained direct flame contact in the overstory, and the leaves were burned off the understory by a low- to moderate-intensity, fairly continuous ground fire. No leaves remain on any of the trees in these stands. Significant charring of the overstory tree boles was not noted.

The duff layer was intact in all aspen stands surveyed. This indicates that the fire probably did not, in most cases, kill the entire tree; even where the leaves and branches were burned, the roots are probably still alive.

The effects of the fire on aspen stands are dependent mainly on two factors: precipitation and ungulate browsing. Good sprouting can be expected in the moderately- to heavily-impacted stands if winter and spring precipitation is at average or greater levels. In the lightly-impacted stands there may be some sprouting that could result in uneven-aged stands. Less browsing would increase the success and quality of regeneration. Late spring frosts could also damage or kill new sprouts; if this happens repeatedly and the stand is heavily browsed, the stand may be lost.

If part of a stand appears to be alive and another part was top-killed but the roots are still alive, the top-killed part may not regenerate due to suppression by the live trees. This can be overcome by cutting all the live trees, which would cause the entire clone to regenerate, or by severing the root connections between the two parts of the stand.

Unless an aspen clone was already in a severely declining condition and the duff burned hot, there should be very little complete loss of aspen stands. This is most likely to occur where scattered aspen occurred in a pine stand that burned very hot with a long flame residence time.

Many of the aspen stands in the fire area had pine stands adjacent to them or encroaching into them. Where the pine stands were killed, the aspen should respond favorably due to the lack of competition. This should result in an increase in the acres of aspen cover type. However, aspen mortality does not always occur immediately after a fire. Trees can leaf out after a fire and take as long as four years to die completely.

Montane Grasslands

Black Hills montane grasslands are wildflower-rich grasslands that are unique to the Black Hills limestone plateau, where they generally occur at elevations above 6,000 feet. The Black Hills Natural Heritage Program ranks these grasslands as globally and state imperiled. The Jasper Fire area includes the four highest-quality montane grasslands identified to date, totalling over 1,400 acres.

A range of burn types occurred on montane grasslands in the fire area, from patchy, low-intensity fires to continuous, high-intensity burns. Grazing pressure, which reduced stubble height, was probably one factor in the low-intensity burns. Grazing may have caused increased water loss and crown damage, however, reducing the vegetation's ability to recover post-fire. One area was affected by dozer line construction. Regrowth of grasses and forbs was evident in some areas as soon as one week after the fire.

Fire probably helps maintain the open quality of montane grasslands by reducing woody vegetation. The montane grassland areas that burned at sufficient duration and intensity to remove woody competitors could benefit from the fire. However, factors such as drought stress, grazing, and invasion by exotic species could threaten the recovery of these grassland plant communities. Soil compaction and damage to plant root crowns due to trampling or vehicles are also threats.

Insects and Diseases

Extensive wildfires occurred throughout the western United States during the summer of 2000. Many questions have arisen in regard to what effect the fires will have on the future landscape of the forest. Unfortunately, the full effects of these wildfires are not obvious immediately after the fire has been controlled, but may accumulate for a number of years. Insect attack following fire is one of the possible causes of delayed tree mortality. Trees that have been weakened by fire could be candidates for attacks by a number of insects.

Insects that may attack trees in the fire area

There are two classes of insects that could be possible mortality agents in areas affected by fire: bark beetles and wood borers. They have different feeding habits and behave differently depending on the amount of fire damage on trees. In general, the probability that of one or both of these insect groups will infest a fire-damaged tree increases with the amount of fire damage up to the point that the cambium is heavily damaged. When the cambium is nearly or completely consumed, the probability declines, as the tree is already dead and no longer a suitable host.

Bark beetles

Bark beetles are the most important class of tree-killing insects across the West. In the Black Hills, there are a number of bark beetle species that attack ponderosa pine. Bark beetles feed on the phloem of their host tree. For bark beetles to complete development successfully, the phloem must be moist enough to sustain them through their life cycle. Trees that have had significant cambial destruction by fire are not suitable hosts for bark beetles.

The most important bark beetle infesting ponderosa pine is the mountain pine beetle, *Dendroctonus ponderosae*. Mountain pine beetles have one generation per year, with its main flight and new attack period being early August. When populations of mountain pine beetles are high enough, they can attack and kill green, healthy trees. At low populations, mountain pine beetles typically attack stressed or damaged trees, such as lightning-struck trees. While it is true that mountain pine beetles do use stressed trees during low populations, they do not preferentially attack fire damaged trees. This does not mean that mountain pine beetles will not attack trees that are moderately scorched and have suitable phloem resources remaining. Generally speaking, fire damaged trees will not cause a mountain pine beetle outbreak to begin; however, mountain pine beetles could very well attack fire damaged trees if beetles are already present in the area.

The second most important bark beetles in the Black Hills are members of the *Ips* group. There are a number of *Ips* species in the Black Hills that attack both pine and spruce. *Ips* beetles are typically far less aggressive than mountain pine beetle. However, *Ips* species have 3 to 4 generations per year. There can be flight periods and new attacks anytime from April through late September, depending on weather. They usually use damaged or stressed trees or larger pieces of slash as host material. They can build up in this material and attack surrounding green standing trees. Like mountain pine beetle, *Ips* beetles host material must have enough phloem that is still moist to complete their development. Trees that have complete cambium destruction will not be suitable hosts. Fire-scorched trees that still have suitable phloem remaining are frequently attacked by *Ips*. Of all the insects that may be factors following the fire, *Ips* species have the potential to cause the most damage. There is a very good chance that *Ips* beetles will kill trees that are highly stressed from fire scorch. Observational data from this year indicate that there is already a high population present across the forest, perhaps caused by snow breakage that occurred in the spring of 2000 and provided ample material for brood production. There is also a chance that surrounding green stands that did not receive any fire damage could have tree mortality caused by *Ips* beetles if they build enough of a population in nearby fire damaged trees.

The third bark beetle that could be of importance is red turpentine beetle, *Dendroctonus valens*. Red turpentine beetles are found throughout the Black Hills attacking pine and occasionally spruce. This beetle typically has one generation per year; however, the flight period is very extensive, with adult beetles flying for most of the summer months. The red turpentine beetles are usually of little concern. They are typically found attacking highly stressed trees in campgrounds and around houses, and even freshly cut stumps. Red turpentine beetles also are frequently found attacking fire-injured trees. Trees that would have survived fire damage may be attacked and killed by red turpentine beetles. Red turpentine beetles may build up enough in fire-damaged trees so that they can emerge and attack nearby green trees. Generally, these attacks are not enough to kill these trees. It is doubtful that red turpentine beetles will build to "epidemic" proportions that would be of concern to nearby standing green trees.

Wood borers

The other group of insects that typically follows fire events is the wood borers. Wood borers are a large group made up of beetles in the families Cerambycidae and Buprestidae. Wood borers are common residents of the Black Hills, where they typically live in fire-scorched, injured, dying, and recently felled trees. Wood borers generally have one generation per year in the Black Hills; however, they have a long flight period. Adults are active throughout the summer. Although they spend the bulk of their time burrowing through the heartwood, these insects do need a small amount of cambial moisture for egg laying, so trees that were completely charred may be too dried out even for wood borers.

Wood borers will not build up in fire-damaged trees and attack standing green trees. They only attack heavily damaged or dead trees. There is no chance of an “outbreak” of wood borers in live trees. The greatest concern with wood borers is in stands that were killed or heavily damaged by the fire where salvage logging is likely. Wood borers cause a much greater level of defect in lumber than do bark beetles because they spend the bulk of their life tunneling through the heartwood of their host. Wood borers are plentiful in the Black Hills and will locate suitable material rapidly. Therefore, to minimize wood borer defect and degrade in fire-damaged and dead trees, salvage operations should begin to take place as soon as possible after the fire.

Tree mortality caused by fire

The above-listed insects have the potential to cause delayed mortality in post-fire situations. There is also the problem of identifying which trees will die due to direct fire effects. Determining which trees will live and die due to fire effects is a difficult task. There are no definite rules - ponderosa pine has been recorded as surviving with as much as 90% crown scorch, but much less scorch can easily kill trees. The Jasper fire occurred in late summer, a moderately good time for tree survival. Many of the trees may have already been in the process of setting buds for the winter and therefore may be somewhat protected. However, this fire also occurred at a time of very hot ambient temperatures, which would have already caused the temperature of plant tissues to be high. It also occurred at a time when there had been no moisture for a long period, meaning the trees were already in a somewhat stressed condition.

Some general guidelines for deciding whether a tree will die include:

- 50% or more crown scorch.
- 50% or more of the bole circumference charred at the root collar. Charring that is hot enough to kill the cambium generally causes pitch streaming. Trees with 50% of the bole circumference blackened and streaming pitch will likely die.
- Scorch heights up to 25 feet.
- Burned-out stump holes within 3 feet of the tree. These will generally produce enough heat to kill a significant portion of the root system.
- Any signs of insect activity (boring holes, frass, boring dust) indicate a tree is going to die.

Of these, the percent crown scorch may be the easiest and most reliable method to use in predicting tree mortality. In the end, these are general guidelines, not hard rules. The amount of tree mortality that ultimately occurs will depend on a number of factors. Adequate moisture in the near future and next spring may help increase survival, while continued dry conditions will likely contribute to the deaths of additional fire-damaged trees that might otherwise have survived.

FIRE and FUELS

Fire behavior, spread rates, and severity associated with the Jasper Fire were the result of a complex interaction of factors. Extremely dry fuels combined with topography and very unstable atmospheric conditions allowed a ground fire to quickly turn into a large, plume-dominated fire.

Fuel moistures for the Jasper Fire area were among the lowest ever recorded. Samples taken in the fire area on September 14 and 15, 2000 showed the moisture content of both live vegetation and large, dead woody material to be far below normal. Remote weather stations for the area show that fine fuels, normally the primary carrier of the fire, had extremely low fuel moisture levels on the first three days of the fire.

Drought indicators such as the Standardized Precipitation Index show that the Black Hills were, in general, severely dry by the end of August. This may have led to a larger than normal component of dead needles in the tree branches. It is estimated that, at the time of the fire, 5% to 10% of the needles on the trees in the fire area were brown or turning brown.

Research shows that fires in the Black Hills have the potential to become large when fuels reach an Energy Release Component (ERC) of 42. Fuel conditions at the start of the Jasper fire were at an ERC of 67, which is a near record-setting index. These conditions indicate that fires will spread rapidly, spotting potential will be quite high, and large fuels that are not normally considered significant to fire spread will burn vigorously. This translates into a fast-moving ground fire with enough heat to easily ignite the crowns of drought-stressed pine trees.

Atmospheric conditions, as indicated by the Haines Index, were at or very near the top of the scale on the 24th, 25th, and 26th of August. High Haines Indices have been shown to promote the growth of large, plume-dominated fires. These conditions, when in alignment such as they were during the Jasper Fire, are likely to lead to large catastrophic fires despite aggressive suppression efforts or management practices. Fire intensity observations from the air, ground, and satellite images show the fire burned hot enough in most areas to produce significant overstory mortality. The most severely affected areas were those in the path of the fire when it made significant runs. These areas included large diameter, well-spaced seed trees. Under these conditions, stand density and structure played a backseat role to the other conditions in the fire environment. Fire control operations did not make significant progress until conditions moderated with cooler and wetter weather, along with arrival of a more stable air mass. The only areas that showed resistance to fire spread were wet draw bottoms associated with aspen trees, and meadows with a significant amount of grazing.

The result of such an intense fire is that very little dead and down material is left, except in pockets where burnout operations took place. This is expected to change over time due to the large amount of standing dead material on the site.

Future fuel conditions, assuming no standing dead removal or grazing, will be highly dependent on the individual site but will rise most sharply in about three to five years as the standing dead timber in the area begins to fall. Once this begins to happen, dead fuel loading will generally range from 20 to 60 tons per acre. Most of this will be material greater than 3 inches in diameter. These fuels will not contribute greatly to fire spread rates, but during very dry years they will burn readily and could present firefighters with control difficulties. Large fuel concentrations may contribute significantly to fire intensity and severity, and may cause hydrophobic soils under extreme conditions. Fires burning in such conditions are also likely to have more severe ecological effects, including noxious weed infestations, mortality to regenerating pine, and significant effects on soils. Grasses and other live vegetation on the site are expected to respond well, with fuel loadings up to 3 tons per acre and fuel bed depths of 1 to 2 feet. Fires in grassy areas are likely to spread quickly, with low severity and low to moderate intensities.

Future fire suppression operations may need to be evaluated for containment objectives in the forest plan. Firefighter safety needs to be weighed against acceptable burn area when working in high-density snag areas within the burn. If roads and trails are obliterated or blocked by fallen timber, access for fire suppression equipment and personnel will be a significant factor if forest plan objectives for containment size are to be met. This will be most important in the fall and spring, when grasses are fully cured.

WILDLIFE

Forest Structure

A stand-replacing fire took place in the parts of the Jasper Fire that burned at moderate to high intensity. Stand-replacing fires change nearly every aspect of vegetation structure: plants are killed, litter and duff consumed, mineral soil exposed, and rhizome sources diminished. In grassland areas, structure returns to pre-fire conditions within three years. Recovery time for shrub-dominated structures can vary from two to 50 years, depending on species. In tree-dominated areas, crown or severe ground fires completely transform habitat. After the fire, habitat is available for insect gleaners, browsers, grazers, and seed-foraging wildlife. It can take up to 50 years to re-establish hiding and thermal cover, security areas for raising young, and nesting habitat.

Ponderosa pine stands that were killed by fire or scorch will become structural stage 1 (grass/forb), as shown by Figures 10 and 11, and will stay in that stage for at least 20 years. Aspen clones that were killed above ground but not below will likely re-sprout next spring *(see Vegetation, above)*. Birch stands and meadows will probably increase in size.

Where the fire burned at lower intensity, most of the understory vegetation was removed while the larger trees survived. This creates open, park-like conifer stands. In some stands, small openings were created when the fire torched isolated groups of trees, creating a mosaic of stand structures.

Understory structure has also undergone major changes. Within the next two years, species such as mountain mahogany, chokecherry, serviceberry, and wild rose will regenerate with new vigor from the nutrients provided by the fire. Common juniper, on the other hand, is a climax species and will probably not return for at least 50 years. Monitoring of vegetation in the Cicero Peak and Shirttail fire areas southeast of Custer indicate that as many as 90 species of grasses and forbs were present within two years after each fire.

Big Game Cover and Forage

The fire killed most of the vegetation providing thermal and hiding cover in about 80% of the area it affected. Some of the stands that were burned at low intensity still provide limited cover. About 50% of the fire area is in Management Area 5.4, big game winter range emphasis *(Figure 2 in Chapter 1)*, which includes an objective to provide thermal cover on 20% of the forested 5.4 area. Before the fire only about 3,703 acres (9%) of the big game winter range was in thermal cover, and this figure has now dropped to 135 acres, or less than 1%.

Management Area 5.4 also includes an objective of providing forage on at least 20% of the area. Before the fire there were approximately 18,731 acres of forage-producing structure, or 47% of the fire area in Management Area 5.4. Post-fire estimates indicate there are now about 36,878 acres of forage-producing structure, or approximately 92% of the 5.4 area.

Roads and Trails

Roads and trails in the fire area will, at least in the short term, have the potential to be more accessible after the fire *(see Infrastructure and Travel Management)*. Habitat areas of importance to wildlife may now be more accessible by motorized vehicle and could be more readily disturbed at critical times. Screening cover adjacent to roads is no longer present to provide escape areas for deer and elk. An increase in off-trail snowmobile riding may occur.

Snags and Down Woody Debris

Snags and dead, down wood are critical habitat components for many species of wildlife in the Black Hills. Fire converts live trees to snags but also burns decayed snags and causes them to fall. Fires may "case harden" trees, hardening the outer wood and slowing decay. This reduces the availability of these trees to cavity-nesting birds but causes them to last longer after they fall to the ground.

The fire created many thousands of snags, many of which are probably case-hardened. Some parts of the forest now have large, isolated snags that will benefit such species as the Lewis' woodpecker. Where large-diameter snags are clumped together, species such as black-backed woodpeckers will benefit. Numerous flickers, nuthatches, creepers, and woodpeckers have already been observed in the fire area. Squirrels were probably most immediately affected by the fire due to loss of decayed snags and cone caches.

Bats that use snags for roosting and nesting will find suitable habitat in the fire area. Trees with loose bark or abandoned woodpecker nests should be common. Insectivorous bats will probably use the high and moderate intensity burn areas for foraging.

Dead wood on the ground is important for many birds, small mammals, insects, and some large mammals. Fire both destroys and creates woody debris. However, large down logs are usually not abundant immediately after a fire, and this seems to be true in the Jasper Fire area. Very little down wood appears to have survived the fire. Though fire-killed trees will start falling soon, it could take up to 20 years to return the forest's down woody component to pre-fire conditions. In the meantime, species that use down wood and vegetation are exposed to predators and are missing a food source. Use of the area by these species will decline in the short term, but will resume over time.

Goshawk Nest Stands

Ten active or historic nest stands existed in the fire area. Only one of the stands was unaffected by the fire. Although the surrounding area was burned, this nest stand is still suitable goshawk nesting habitat. Seven of the stands were completely burned by the fire and will not be suitable nesting habitat again for many years. Two stands partially burned, with some overstory trees likely to survive. The presence of these remaining trees may make these stands useful as nest stands sooner than those that were completely burned.

Water Sources

Water limits the distribution of wildlife in the burn area. The underlying limestone is very absorbent and little overland flow occurs. There are no perennial streams, though some flow intermittently. Scattered springs exist. Natural water sources had been augmented by construction of water catchments referred to as “guzzlers”. Nineteen of these structures existed. Eight were destroyed by the fire, nine were damaged, and two were not affected. Replacement costs are estimated at $30,000.

Direct Effects on Wildlife Species

Most of the area's wildife escaped the fire physically unharmed. Reports from the fireline during active burning indicate that many of the large mammals moved to the perimeter of the fire or to unburned islands. Once the fire passed, many of these animals moved back into the burned areas. Deer, elk, turkeys, and other birds that returned to find their home ranges burned over probably moved back outside the burned areas in search of food, water, and cover. Big game species with home ranges that lie both in and outside the fire area continue to travel between burned and unburned areas, depending on their needs.

Many small burrowing animals most likely survived the fire by retreating to underground dens and tunnels. Squirrels have been seen since the fire restocking their winter caches and foraging for cones still attached to burned trees. A few voles and mice have been seen, indicating that at least some survived. Non-burrowing small mammals such as rabbits probably were killed by the fire.

Birds likely flew outside the burned areas to escape heat and smoke. Had this fire occurred earlier in the year, the effects on nesting birds would have been devastating; but, given the late-summer timing of the fire, most birds had probably fledged their young and begun to migrate to winter territories. Songbirds now seem to be concentrated in areas burned at low intensity and where water is available. High-intensity burn areas were eerily silent soon after the fire. Small insect-gleaning birds have now been observed checking the black trees and ground for food, returning a little of the normal sound and life to the forest.

Some animals did succumb to the fire. The South Dakota Department of Game, Fish and Parks indicates that one mountain lion, one deer, and one fawn with radio collars are known to have been killed. A few other deer and squirrel carcasses have been seen, and there has been one report of an elk carcass. Crews have observed a number of deer, elk, squirrels, chipmunks, and turkeys that seem to show evidence of physical stress related to the intense heat and smoke. Most of the slower-moving animals, such as porcupines, raccoons, and skunks, probably perished in the fire.

Indirect Effects on Wildlife Species

As the fire area recovers, habitat and wildlife use patterns will change substantially. In general, there will be a shift from forest-dwelling species to those that use early successional forest and forest/meadow edges. Some of the species that inhabited the area before the fire included brown creeper, ovenbird, golden-crowned kinglet, hairy woodpecker, black-backed woodpecker, red crossbill, goshawk, sharp-shinned hawk, great horned owl, saw-whet owl, white-tailed deer, elk, porcupine, marten, and red squirrel. Many of these species will no longer find suitable habitat in the fire area. Species likely to inhabit the area in coming years include sparrows, mountain bluebird, kestrel, Lewis' woodpecker, red-headed woodpecker, northern flicker, white-tailed deer, mule deer, elk, pronghorn antelope, ruffed grouse, sharp-tailed grouse, and rodents such as mice, gophers, and wood rats.

The fire consumed elk and deer birthing habitat. The loss of this habitat will likely increase predation of deer fawns and elk calves in the spring of 2001. Within five years there should be an increase in this habitat as grasses, forbs, shrubs, and hardwood trees regenerate.

Mosaic burns created prime brood-rearing habitat for Merriam's turkeys. Turkeys prefer small, grassy openings with abundant down wood and adjacent cover for raising broods. Roosting habitat has, however, decreased.

Elk populations will probably increase as they did in the Cicero Peak and Galena fire areas. These increases will be primarily due to increased forage availability, and may be tempered somewhat by the decrease in cover and increase in motorized access. Private land in and around the fire will probably experience more use by animals seeking cover and forage until these habitats are again available in the burned area. Animals are likely to increase use of private land this winter and possibly next, with long-term effects depending on availability of water, forage, and security in the burned area, as well as big game harvest levels set by the State. Extensive road systems and ease of off-road travel may cause an increase harvest rates during hunting season.

Many snags existing before the fire were consumed, but the fire also formed an abundance of new snags. Loss of the pre-existing snags will reduce habitat available to secondary cavity-nesting birds this spring, as they depend on cavities excavated by other birds. The increase in snags will directly benefit primary cavity-nesters and other insect-eating birds. Nesting habitat for ground- and shrub-nesting birds will be in short supply for at least a one-year period.

Bats and Cave Resources

There are 11 known caves in the fire area, including Jewel Cave, one of the largest caves in the United States. They are part of a karst landscape, an integrated, dynamic system affected by changes in water and air flow. Disturbances in the hydrologic system, including those caused by above-ground events, will affect the karst and caves. The fire and subsequent management could be a major disturbance having far-reaching effects on Jewel Cave and other caves.

Eleven species of bats are found in the Black Hills, four of which are considered sensitive species. Ten of the species use caves and mines, and ten are dependent on large snags. Caves in the Jasper Fire area are used as maternity roosts and hibernacula, critical habitat for survival of bat populations. Bats also use the cave as night roosts.

Biologists visited five of the caves after the fire. Vegetation above four of the caves was burned at moderate to high intensity. One cave was entered; it had a smoky smell, but bats were present. The interior did not appear to have been damaged by the fire. However, since vegetation around the cave entrances is gone, the caves are more visible and vulnerable to human disturbance. Loss of vegetation will also change air flow patterns around the cave mouth, affecting temperature and humidity of the cave microclimate. This could reduce the caves' suitability for use as maternity and hibernation roosts.

Snails

Surveys before the fire found sensitive snail species in seven locations around the fire area. Snails are able to withstand minor fires, but intense fires generally kill all land snails. Most of the known colonies experienced moderate to high intensity burns.

Biologists visited two of the survey sites after the fire. No snails were observed. However, due to drought conditions, snails may well have retreated underground or to moist rock faces before the fire. Because of this, snails will probably persist in these areas through the winter, but they may ultimately not survive the change in microclimate caused by loss of vegetation. Some colonies were probably extirpated by the fire. However, other colonies may grow where seeps, springs, and aspen stands expand. Although snails move slowly under their own power, their small size allows some passive dispersal by wind, heavy rains, and snow melt. This may provide a means for snail colonies to disperse to more favorable habitat.

Butterflies

Two sensitive butterfly species may inhabit the Jasper Fire area. The tawny crescent is associated with riparian areas and damp sites. The regal fritillary is associated with open prairie habitats. These species lay their eggs on vegetation, and the fire mostly likely destroyed the egg masses except in wet areas that did not burn. The fire will, however, probably increase the vegetative diversity in the area and provide more potential habitat for each of these butterfly species.

Amphibians and Reptiles

Snake species that occur in the fire area use rocks, logs, burrows, and vegetation for cover. They feed on insects and small mammals. While some snakes may have escaped the fire in underground burrows or rock crevices, others probably perished as down logs and snags burned. Little or no cover remains in areas of moderate to high intensity burn, leaving snakes susceptible to predation. In addition, most of their prey base has been lost. Snake populations are likely to decline for two or three years until vegetation and down wood accumulate. Recolonization will occur from adjacent unburned or lightly burned areas.

Amphibians are generally associated with aquatic or riparian habitats, of which there are very few in the burn area. Some springs were known to support populations of northern leopard frogs or tiger salamanders. Chorus frogs are common throughout the area in the spring. Aquatic and riparian habitats will probably expand, at least in the short term, due to reduction of tree evapotranspiration. These new areas may be colonized by frogs or salamanders.

INFRASTRUCTURE

Roads

There are approximately 508 miles of road within the perimeter of the fire, or about 4 miles of road per square mile of land. Included in this total are 31 miles of arterial roads, 67 miles of collector roads, and 409 miles of local (non-system or two-track) roads.

Fire suppression caused minimal damage to roads. Less than 10 miles of road within the perimeter were used as dozer lines, but more than 120 miles of dozer line were constructed off roads. The dozer lines are being recontoured and slashed in as part of fire suppression rehabilitation currently under way. The roads used as dozer lines need only minor repairs, and will also be fixed as part of the fire suppression rehab. Between 20 and 30 miles of road outside the fire perimeter will need minor repair due to heavy use during suppression activities, and routine maintenance will take care of these problems.

Rainstorm events that increase runoff may tax the drainage structures on existing roads. The Burned Area Emergency Rehabilitation (BAER) report did not identify this as an immediate concern, but additional evaluation of long-term needs will help determine if there is a need for additional or improved drainage features.

Timber salvage and associated log haul would probably need to use County roads that normally have load restrictions during spring breakup. This may limit some haul opportunities. Timber sale contract road maintenance provisions would cover most road needs for salvage operations. Some minor reconstruction work may be needed.

There are five active timber sales in the fire area. Road work required for these sales includes one mile of new construction, completed in 1999; 20 miles of reconstruction, under way, mostly completed in 1999 and 2000; 21 miles of reconstruction work not yet started, and 75 miles of pre-use maintenance, partially completed. Two miles of the reconstruction work not yet accomplished involves relocating existing roadbeds out of sensitive soil or water concern areas.

Utilities

See “Special Uses”.

RECREATION

Recreational activities in the fire area include hiking, driving, trail riding, snowmobiling, and hunting. The fire affected the recreational experience by changing the esthetic value of the forest, creating a mosaic pattern of burned, partially burned, and unburned vegetation.

Hell Canyon trail is a developed 5.5-mile loop located entirely within the fire area. The landscape crossed by this non-motorized trail sustained low to moderate amounts of fire damage, though some of the ridgetops were completely blackened. In general, soil resources and organic matter remain intact. This means the area can still sustain vegetation. Re-growth of grass and forbs is already occurring. Some hazard trees have been removed, but many snags are still standing and could fall on the trail.

Snowmobile Trail 1 runs through the fire area for 11.5 miles. The trail runs mostly along roads and in meadows. Users can expect to see a mosaic of fire intensities, with green trees along the edges of many of the meadows. Hazard trees and down trees could exist where the trail crosses forested areas, but the overall effect of the fire on snowmobile trails is minimal.

Recreational driving on back roads, hiking, and hunting could be dangerous for some time as snags with burned roots continue to fall.

SPECIAL USES

Several groups and individuals hold permits for special uses in the fire area.

Three hunting outfitters have permits to conduct guided hunts in the fire area. However, the permits include areas outside the fire perimeter where they can continue business.

Two electric utilities, Black Hills Power and Light and Black Hills Electric Cooperative, have permits for power lines in the fire area. All lines are above-ground. At least 59 wooden structures sustained severe damage, and, where the fire's temperature exceeded 1,400° F, wires were melted. Both companies are considering abandoning sections of line due to the expense of repair.

Golden West and RT Communications have telephone lines in the fire area. Golden West lost 2,738 feet of above-ground line along Bull Springs and Alkali Flats and one pedestal box in Lithograph Canyon. All other lines are underground and were not damaged by the fire.

Two groups hold annual events at locations in the fire area. The Mountain Man Rendezvous held by Muzzleloaders of the Black Hills could feasibly be moved an area unaffected by the fire. The Mountain Region Endurance Riders' horse endurance ride could be affected as dead trees fall across the trail and increasing the number of obstacles. Standing dead trees along the trail would present a hazard.

The South Dakota Department of Transportation and Custer County each have a road easement in the fire area. Increased traffic associated with the fire caused minor, short-term effects to the roads.

TRAVEL MANAGEMENT

Most of the fire area is open to motorized road and off-road travel. The southeast part of the fire area is designated as seasonally restricted.

Many two-track roads in the area had been closed to travel in recent years using berms or slash or by ripping the roadbed. Vegetation barriers helped to implement these closures. With much of the vegetation gone due to the fire, many of these previously closed roads will be open to travel. The same is true for the few existing gate closures, mainly used as seasonal closures for wildlife security.

In the short term, many of the closures will be ineffective. As dead trees begin to fall, an increasing number of barriers to motorized travel will appear, both on and off roads. Felling of dead trees in strategic locations would help this natural process along and would discourage use in areas with sensitive soils.

The area's transportation system serves a variety of access needs for forest users. Much of this on-road use should not be affected by the fire. Arterial and collector roads generally are gravel-surfaced and, with routine maintenance, can remain open. Some of the local system roads provide access for administrative uses such as range management, noxious weed control, fire suppression, and vegetation treatments such as thinning and slash disposal.

SCENERY

The Jasper Fire burned into the viewshed of US Highway 16 between Custer, South Dakota, and Newcastle, Wyoming. There is a high level of public concern for scenery along this route. The topography along the highway within the burned area is rolling, with limited views beyond the foreground. The fire burned in a variety of intensities along the highway; there are scattered areas of high-intensity burn interspersed with moderate and low intensity. From the road it appears that high-intensity burning was limited to a few hillsides or small drainages, and the large area of the fire is not evident.

Where less than half the trees over 8 inches in diameter were killed by the fire, the viewshed should maintain a natural appearance of forest and meadow. As fire-killed trees decay and fall, the public will have an opportunity to witness the dynamic natural processes that take place after a fire. For a period of time, there will be a large number of trees on the ground in various states of decay. Overall, it does not appear that the fire caused an unacceptable level of damage in this viewshed.

Away from the Highway 16 corridor the effects of the fire are much more evident. The fire burned at high intensities across large areas, especially along Forest Road 284 (the Custer Limestone road). Due to the rolling topography and the location and design of the road, however, special treatments to benefit scenery do not appear to be necessary.

HERITAGE

Introduction

The Jasper Fire area contains a rich sample of archaeological and historic sites that represent over 7,000 years of human occupation in the Black Hills. Native American sites include open campsites, stone tool quarry sites, rock shelters, and petroglyph locations. Several Traditional Cultural Properties of religious and cultural significance to contemporary Native Americans are also located in this landscape. Historic properties represent the significant themes of historic mining, logging, ranching or farming, and the Civilian Conservation Corps. Many of these properties exhibit potential for public benefit through interpretive and research projects. Attainment of public benefit goals can be accomplished through long-term management and preservation of these significant properties.

Inventory Strategy

After the fire, crews surveyed firelines constructed by heavy equipment (dozer lines) on slopes of less than 20%, drop points, campsites, and graded safety zones. Dozer lines on slopes of greater than 20 percent, dozer lines developed on existing roads, and hand-constructed firelines were not surveyed unless significant previously recorded properties were located in those settings.

Impacts on previously recorded properties were documented. Site boundaries were flagged for avoidance or for special measures to be implemented during rehabilitation efforts. Newly discovered sites were documented and flagged.

Existing Condition of Previously Recorded Properties

A total of 69 properties evaluated as “eligible” or “potentially eligible” for the National Register of Historic Places are located in the Jasper Fire area. An estimated additional 120 properties evaluated as “not eligible” for the National Register of Historic Places are also located in the Jasper Fire area.

Each of the known eligible or unevaluated properties was inspected. Two prehistoric sites were impacted through construction of fireline by bulldozers. The impact was not severe and hand rehabilitation of the fireline is recommended.

Fifteen sites were exposed to high levels of fire intensity. In these areas, the fire had a substantial effect on historic properties containing wood features. Open surface scatters of lithic material were also significantly altered. Eleven sites were exposed to moderate levels of fire intensity, while 13 sites were exposed to low levels of fire intensity. The Jasper Fire did not affect 30 previously recorded properties. Initial site inspections indicate that, in most areas, the fire was of high intensity and low duration. It is possible that buried components were not heavily impacted unless burning stumps and roots were present. None of the impacted properties were submitted to the BAER team as an emergency stabilization need, although stability of several sites is of long-term management concern.

Existing Condition of Newly Discovered Properties

Twenty-five new heritage resource properties were recorded through an inventory of bulldozer constructed firelines. Fourteen sites are prehistoric in age. Nine sites are historic, and two sites contain both prehistoric and historic components. Guidelines call for either mechanical or hand rehabilitation depending on the significance of an individual property. Seven of these newly discovered sites exhibit high potential for research and public benefit.

CHAPTER THREE

Recommendations

RECOMMENDED ACTIONS

Introduction

The Assessment Team developed the following action items related to the Jasper Fire's effects. The items are not listed in priority. Not all of these action items may be completed. The Forest Leadership Team must determine the priority and need for action based on budget, workforce, and other criteria. The recommended actions are divided into four categories: Safety, Resource Protection, Value Recovery, and Monitoring/ Evaluation/Adaptive Management. Some of these items can be placed in more than one category.

Safety

Roads

There are many dead trees along roads that pose a safety hazard. We cannot predict when these trees will fall; some could fall today or within the next few months. Others may stand for many years. Dead trees that might fall on or across the road prism should be felled immediately to remove the hazard to the public and employees working in the area. The focus should be on main roads - collector, arterial and some local roads. Travel Management planning should be conducted to determine if dead trees on other roads should also be felled. Appropriate methods should be used to inform the public of travel hazards.

Trails

The entire Hell Canyon foot trail and a portion of the State/Forest Service snowmobile trail system were affected by the fire. Signs and wooden erosion control devices that burned should be replaced. Dead trees pose a potential hazard along these trails. Snags should be felled along the Hell Canyon Trail, and the Forest Service should work with the South Dakota Department of Game, Fish and Parks to determine actions necessary to protect public safety on the snowmobile trail. This might include felling hazard trees, closing a portion of the trail system, or providing public information on safety hazards. The Forest Service should also evaluate the Endurance Trail horse ride and Mountain Man Rendezvous special use events to determine if any changes are needed to the permit requirements.

Employees

Black Hills National Forest and other agency personnel will be working within the fire area. There are many hazards in the area, especially the risk of falling snags. Job hazard analyses should be prepared, and employees working in the area should be made aware of the hazards. The Forest Service should develop a plan for future fire suppression within the Jasper Fire area, recognizing special hazards and any other objectives that might be developed from future analyses. Hazardous trees may need to be felled.

Contracts and Permits

Hazards within the fire area should be brought to the attention of contractors and permittees operating within the area. Safety requirements should be acknowledged. Hazardous trees may need to be felled.

Public

There are various hazards within the fire area, most notably the potential for falling snags. The public should be notified of these hazards. This might include notification in State and Federal brochures and handouts, signing, and other methods deemed appropriate.

Resource Protection

Noxious Weeds

Noxious weeds are already present within the fire area, and are likely to rapidly spread as a result of the fire. The Assessment Team believes weeds are one of the biggest issues facing the fire recovery effort. An aggressive monitoring and treatment program is needed to deal with noxious weeds. This effort needs to begin immediately. The Forest should consider contracting some of the treatment work, especially the work which could be conducted over the next month.

Roads

Moisture is currently lacking in the area. We recommend holding off on most road-related work until there is significant moisture in the ground. Increased road damage will result from attempting the work in dry conditions, including: loss of fine soils, loss of grass root systems in native surface road beds, and ineffective drainage structures. Excessive washboarding and loss of fine surface material on gravel roads has already occurred from post-suppression blading of roads.

Road maintenance needs should be prioritized as follows: 1) rehabilitation of roads used as firelines; 2) access roads used in suppression; and 3) interior roads susceptible to erosion. Annual and grid maintenance should be considered for the entire fire area next spring, or this fall if there is adequate moisture.

Road inventories and hydrologic evaluations are needed this fall to determine the need for additional drainage structures and erosion control measures. We may need to reinforce some crossings or provide other road surface hardening (gravel) if water tables rise and saturate roadbeds. Road restrictions may be necessary if roadbeds soften.

Road requirements for timber haul under existing timber sale contracts should be reevaluated to determine if modifications are needed due to changed conditions.

Any roads used for timber salvage should be closely monitored for pre-use, during use, and post-use maintenance needs. Hauling on native surface roads during frozen conditions should be encouraged, as feasible.

Travel Management

There are many system and non-system roads in the fire area. These provide abundant access. The fire removed large areas of big game cover and exposed bare soils in many places. A travel order is needed immediately to confine vehicle travel to designated routes only. This will provide additional security for big game, reduce impacts to soils, and help limit the spread of noxious weeds. This designated route order should be in effect when the current closure order is rescinded. District Rangers need to determine which roads should remain open to the public over the next two years. A Travel Management Plan should be developed within the next two years, with public involvement, to determine long term access management needs.

Fire and Fuel Hazards

There are potential fire hazards within the area that need to be addressed, especially adjacent to private land. As dead trees fall to the ground, fuel loading will range from 20 to 60 tons per acre over much of the burn area. These large fuels will not cause new fires to spread rapidly but could increase fire intensity and severity under dry conditions. High fuel loads should be reduced adjacent to private lands and other areas of concern regarding weed infestation, mortality to regenerating pine, and severe effects on soils. An evaluation needs to be conducted and a long term plan developed to reduce these hazards.

Stand Maintenance

In low intensity burn areas, some of the stands are now in a condition where the ground and ladder fuels have been reduced or eliminated. These stands should be identified and long-term strategies developed to maintain these stand conditions, as appropriate. This maintenance might include mechanical methods or prescribed burning.

Aspen Maintenance

Aspen stands should be evaluated on an individual basis in regard to 1) protection needs, such as fencing, 2) regeneration treatment needs and methods, and 3) the need to remove competition in the form of surviving pine trees.

Montane Grasslands

The weed monitoring and suppression program should pay specific attention to weed expansion within the montane grasslands. Future cattle use and distribution within these grasslands should be made part of an overall site-specific monitoring program, as specified later in this section. Special attention should be given to utilization standards on the montane grassland portion of the allotments. Careful consideration should be given to the location and necessity of any new road building within these grasslands. Any salvage conducted adjacent to these grasslands should be conducted in a manner that minimizes or eliminates soil disturbance. For example, slash piling should be prohibited in these areas.

Value Recovery

Grazing

The fire burned over a large area of rangeland. It damaged fences, water pipelines, water storage structures, and other range improvements. Eleven grazing allotments were either partly or wholly affected. Allotment management plans will need to be completely revised for some of the affected areas, fences will need to be rebuilt or relocated, and water distribution structures rebuilt or relocated. There will be a significant impact to some grazing permittees in two ways. First, there is a large amount of work that needs to be done to fix range improvements so that cattle can be properly managed and distributed. Traditionally, the permittee provides the labor and the Forest Service provides supplies for this type of work. Second, areas on the allotments that burned at a high or moderate intensity will not be available for cattle use in the short term in order to protect soil and site productivity and ensure vegetative recovery. The determination of when cattle can return needs to be based on site-specific monitoring, but indications are this could be a year or two, depending on a number of factors. A monitoring plan needs to be developed to address this issue. Team members involved with the plan and actual monitoring should include representatives from South Dakota State University, South Dakota Department Game, Fish and Parks, and the affected permittees. We should promptly inform affected permittees of the potential effects to their operations.

Fence right-of-ways should be cleared of standing dead trees for approximately 50 feet in the high and moderate burn intensity areas, or a sufficient distance to protect fences from falling snags.

Hazard trees should be cleared around water improvements.

New fences should be contructed, or allotment boundaries changed, where natural barriers to livestock movement were destroyed by the fire.

Reforestation

The fire killed ponderosa pine trees over an extensive area. There is concern that natural regeneration may not occur in some areas where it is desired. Monitoring is needed to determine if planting should be conducted to meet desired goals. Seed should be gathered now to ensure stock is available in case planting is required. If required, planting could begin in 2003. Seed released from scorched areas should be monitored, and sent to specialists to determine if it is viable. Green seed sources within and adjacent to the burn area should be retained, as appropriate.

Specific areas cannot be identified at this time to plant. However, when site specific analysis is conducted the following should be considered: soil type and depth, site index, aspect, available shelter on the site, reason(s) for planting, amount of rock in the soil, amount of competing vegetation, need for plantation protection, and likelihood of obtaining regeneration by other methods (natural or otherwise).

Areas identified or proposed for planting should be those with the greatest likelihood of success due to the high cost of planting. Cost can range from $300 to $600 per acre. The areas with the greatest chance for success are those with soils that have higher water holding capacity, low amount of rock fragments, and a higher site index. This is not to say these are the only areas that should be considered for planting; other resource needs, such as the desire for hiding cover or the ability to develop thermal cover in the future, may produce a need to reforest a particular area. If so, then sites within these areas with a high probability of success should be favored.

Where trees are planted, high fuel loads should be reduced. This will protect the investment from intense fires.

Presently the Forest has over 750 pounds of seed stored in the regional seed bank that can be used in this seed zone. But if a large planting program is undertaken, a cone collection effort should be considered to provide an adequate supply of seed or replace the seed used from the bank.

Unless some other resource need exists to plant ponderosa pine, it is recommended that no planting of trees occur on the following soil types that formed under grass: BsB, CxC, HtG, JhD, PbD, PcD, ReC, RnG, SpE, and WtB.

If hand planting is desired, it is recommended that it occurs on soil map units CkC, SyaC, SybC, and SycE. There are portions of other soil map units that also have a high potential for seedling survival. Planting can occur on other soil map units but practices such as using special planting stock, bedding, planting on north facing slopes, etc., may be needed to offset the seedling mortality hazard.

Timber Salvage

The Jasper Fire burned a large acreage of trees, killing the majority of them on approximately 71% of the fire area. Many of these trees were small ponderosa pine, less than 9 inches in diameter. Pine of this size is not considered merchantable as sawlogs to make lumber, but those between 5 inches and 9 inches in diameter can be used to make products such as posts and poles. They can also be used to make chips, but not after the trees are burned. The value of burned trees this size is marginal at best. Pine larger than 9 inches in diameter should be considered for possible salvage to recover their economic value. Approximately 239 million board feet of pine greater than 9 inches in diameter is estimated to have been killed by the Jasper Fire. Most of this volume cannot be salvaged because it is either spread out in low densities across the landscape, making its recovery uneconomic, or it is on steeper slopes where salvage harvest could cause erosion and loss in site productivity. Most of the potentially salvageable timber is within existing timber sale contract areas *(Figures 8 and 9 in Chapter 2)*. A smaller amount of salvageable timber is located in two areas outside existing timber sales *(Figure 7 in Chapter 2)*.

A primary objective of the salvage timber sale program (Forest Service Manual 2435) is to provide for removal of damaged or dead timber as soon as practically possible to avoid unnecessary loss of value and volume. It is Forest Service policy to: a) protect life and property on private and public land, b) respond to catastrophies such as wildfire, c) reduce the risk of fire and insect/disease attacks, and d) protect soil, water, fish, and wildlife resources. For project analysis and documentation, the Forest Service Manual recommends using existing information to the maximum extent possible, tiering planning documents to those already existing, and using categorical exclusions where feasible.

Five Timber Sale Contracts are located partly or wholly within the fire area. Four of these sales are part of a recently negotiated legal settlement that specifies conditions under which these sales must operate. This includes the Crawford, Dumbuk, Crooked Uncle, and Lemming Timber Sales. There is approximately 80 million board feet contained in dead trees within these four sales. The fifth sale, Limestone, was only marginally affected by the fire.

If salvage occurs, use the following general practices:

Focus harvest activities on slopes of 20% or less. Site-specific design of yarding to minimize hydrologic risk may allow harvest on steeper slopes, but would be the exception rather than the rule.

On slopes 20% or greater:

Yarding methods should be designed to avoid increasing overland flow and connecting disturbed areas to existing channels. Site-specific design of yarding systems with the hydrologist and pre-sale forester may allow harvest on some of these slopes. Methods that do not disturb the existing hydrologic functioning of the slopes would be preferred. These practices may include forwarder systems and yarding over snow.

On slopes 20% or less:

Yarding methods that do not disturb the existing hydrologic functioning of the slope are preferred, and could be used without further hydrologic review. These practices include forwarder systems, yarding over snow, etc.

On sites where duff was consumed by the fire, yarding methods should be designed to avoid concentrating overland flow and connecting disturbed areas to existing channels. To achieve this, site-specific design with the hydrologist and pre-sale forester and later consultation with the sale administrator would be needed. Some tracts of ground may not be economically yarded to meet soil and water objectives and therefore it is recommended that the on-site design be completed before final agreements with purchasers are reached.

On sites where the duff is retained (wholly or partially), yarding methods should be used that do not disturb the existing hydrologic functioning of the slope. These sites are the most sensitive because disturbance has the most potential to increase overland flow or sediment transport off site. On sites where yarding methods that do not disturb the existing hydrologic function are not used, site-specific design with the hydrologist and pre-sale forester and later consultation with the sale administrator would be needed. Yarding methods that have high potential to disturb duff, such as partial suspension tractor skidding may exclude tracts of ground from yarding. It is recommended that the on-site design be completed before agreements with purchasers are reached.

Have Resource Specialists develop a guide for mitigation tied to site conditions that salvage layout personnel can use on the ground. Include guidelines on salvaging along defined channels.

If areas of moderate or high fire intensities are salvaged, only the boles of the merchantable salvaged trees should be removed. Retain cull logs and tops of trees on site. Maintain 5 - 10 Tons/Acre of coarse woody debris (>3” on site).

Lop and scatter slash. The more the slash is in contact with the ground the better.

Designate skid trails and use the minimum amount needed. Skid trails need to follow the contour of the slope. The hydrologist needs to review the skid trail design prior to salvage activities in high and moderate intensity areas.

Avoid removal of remaining live vegetation near caves. Avoid removal of vegetation serving as big game cover. Avoid leaving salvage areas devoid of snags and down woody material.

Do not conduct activities in Severe Erosion Hazard areas.

Salvage activities should not occur on soil map units VkE, VoG and RnG in areas of moderate and high fire intensities.

Limit salvage disturbance activities to dry or frozen conditions for soil map units CkC, VkE, SyaC, SybC and SycE. If there is any salvage activity that cannot be avoided in meadows, limit those activities to frozen or snow packed conditions.

Roads, landings and skid trails are areas that are likely to become compacted. These areas, if compacted, need to be ripped and revegetated following use and closure of salvage-harvested areas. Skid trails will be water barred, seeded and scattered with slash.

No salvage disturbance should occur in those areas that have a high potential for mass movement. These show on the fire severity map as Low/Moderate and Moderate Severity for soil map units VkE, VoG and RnG.

Retain all green trees within the fire perimeter, if possible, to provide future habitat for wildlife, visual quality, soil and water stabilization, and natural regeneration opportunities. It is suggested that trees with 25 percent green crowns and at least 50 percent of their boles not exhibiting cambium damage, be retained for above stated opportunities.

Infrastructure

The Jasper Fire caused substantial damage to fences, water developments, and other infrastructure on the Forest. There is a need to identify potential drainage problems on Forest Development Roads (FDRs) and correct the problems. This could include installing or replacing culverts, drain dips, bridges, and other structures. This is needed to respond to potential increased runoff and erosion in the fire area. Many directional and other road signs in the fire area have been damaged and need to be replaced. Road gates have also been damaged and need to be replaced, relocated, or removed, or other barriers installed.

Parking barriers, bulletin boards, and directional signing needs to be replaced at the Hell Canyon Trailhead.

Approximately 150 miles of range fence needs to be replaced or relocated at an estimated cost of $990,000. Three water pipelines need to be replaced or repaired (estimated $110,000), and about 71 water developments need repair and maintenance (estimated $130,000). Two new powerlines could be constructed to provide power for water developments and distribution.

Eight wildlife guzzlers need to be replaced, and an additional seven need to be repaired. The total cost of guzzler work is estimated at $30,000. Some exclosure fences around springs may need repair or replacement.

A large number of the approximate 1,000 section landline corners probably have been damaged or impacted in some way. Bearing trees have been killed, making it difficult to locate survey monuments. These bearing trees should be protected by “high stumping” the dead trees before they fall and evidence of their location is lost. Resurvey or marking along private land boundaries also needs to be conducted.

Utility companies need to assess utility line needs in the fire area. If these lines are abandoned, existing poles and wire must be removed from the Forest. Damaged private land fences should be relocated along the surveyed property boundary, where applicable.

MONITORING, EVALUATION AND ADAPTIVE MANAGEMENT

Education and Interpretation

There are tremendous opportunities for public education and interpretation regarding the Jasper Fire. An education and interpretation plan should be developed. We recommend that community, service, and other groups work with the Forest Service to develop and implement this plan.

Monitoring and Research

There are many monitoring needs and abundant research opportunities related to the fire's effects and recovery. The Forest should aggressively seek partners in other State and Federal agencies, Universities, organizations, and the Rocky Mountain Research Station to help in the development, funding, data collection and analyses for these efforts. Monitoring needs and research opportunities are many and varied, but might include: vegetative response and recovery; snag fall and retention rates based on diameter and other criteria; effects on caves, cave habitat, and bats; effects on amphibians, big game, snails, goshawks and other birds; and hydrologic and soil effects.

Monitor aspen stands over next 5 to 7 years for regeneration; pay special attention to stands with combination of live trees and areas of top-kill. monitor for new aspen stands and expansion of existing aspen stands.

Monitor montane grasslands for noxious weed invasions and the effects of disturbance on vegetation recovery rates and species composition.

A selection of eligible properties should be managed for research and long-term public benefit. Benefits could include on-site field schools such as Passport In Time projects or off-site programs and interpretive products. Eligible properties at risk due to post-fire erosion should be monitored.

It is recommended that the Jasper Fire locality be utilized as an analysis area for the study of fire effects on heritage resources. Data concerning the effects of fire is a critical element in the development of heritage compliance strategies for prescribed and wild fire events. The mosaic character of the Jasper Fire and the presence of a variety of heritage resources would provide a unique opportunity to compare and contrast impacts on a variety of site types by different levels of fire intensity.

Interpretive projects concerning the Jasper Fire should include the historic human dimension inherent in the current landscape. Native Americans with strong cultural ties to this area should be provided an opportunity to participate in interpretive efforts.

The fire area along Hell Canyon Trail could provide educational experiences for visitors and a teaching aid for nearby schools.

Consider creating a vista along Highway 16 where the effects of the fire and fire recovery can be seen.

Monitoring should include photo plots, range cages, rooted-nested frequencies, and a permanent exclosure area.

A monitoring plan needs to be developed for range readiness, as previously presented. Additional monitoring using exclosure cages should be conducted to determine wildlife utilization in specific areas. Photo transects should also be included. Fire effects on montane and other grasslands should be evaluated.

Hydrology

A number of partners are interested in studying the effects of the fire on water flow and water quality. Little research has been conducted into fire effects on hydrology due to the inability to install study plots quickly enough. The Jasper Fire presents a unique opportunity to study fire hydrology due to the existing partnership that produced the Black Hills Water Study. Members of this group have been discussing the design of a study of the Jasper Fire since early September. Two major areas of interest are being considered: 1) changes in the recharge of the aquifer and increases in overland flow, and 2) changes in water quality, including sedimentation. Study of these topics would benefit the Forest Service and the Black Hills National Forest in the areas of Burned Area Emergency Rehabilitation (BAER), prescribed fire, and timber sale effects analysis. The Forest would need to contribute some money and personnel to this effort to make it successful. The money already exists in the form of BAER funding for monitoring. Personnel needs would be minimal this year, but may increase in the next two years as data is collected. Currently the USGS, South Dakota Department of Environment and Natural Resources, Rocky Mountain Research Station, and the West Dakota Water Water Development District are working together to develop a final proposal. Funding from sources other than the Forest Service can be committed within a few weeks, and implementation of the study could begin as early as the first of October.

Satellite Analysis

Due more to chance than design, numerous elements came together that allowed the Forest to use satellite imagery in its assessment of the fire's effects. The assistance of the EROS data center (a USGS depository of remotely sensed data based in Sioux Falls, South Dakota) has opened up the possibility of evaluating the usefulness of a new type of satellite imagery in forest management. The imagery has very fine resolution (1 meter black and white, 4 meter "color" bands) and can be collected frequently. The increased resolution may improve our ability to accurately identify smaller features on the ground. Stands described as mixed by LANDSAT classifications may be separated into individual components. Road, noxious weeds, and hardwoods may be easily identified in these scenes. The EROS data center is willing to provide technical support with image classification, as well as some data, at no cost. The Forest would need to commit personnel to collect field data and classify images.

Seeding

The BAER Team conducted a quick assessment of the Fire area and determined that grass seeding was not needed as an emergency soil erosion protection measure or to minimize the potential for noxious weeds. The Jasper Assessment Team also addressed the seeding issue, but suggest that seeding should be conducted in some areas. Experience with burn piles in the area indicates that seeding helps control weed infestations. Non-persistent cereal grains should be used for this seeding and applied this year. This should provide ground cover but also allow native vegetation to take hold. The Assessment Team recognizes there are differing opinions on the value of seeding within fire damaged areas. For this reason, we suggest that control areas be established and monitored to determine differences between the seeded and non-seeded areas.

Photo Points

A series of permanent photo points should be established to document and monitor changes within the fire area over time. This project could be contracted or possibly conducted by the Forest Service or other government agency.

Appendix A

Jasper Rapid Assessment Team Members

Team Leader - Robert Thompson

Core Team Members and Team Position

Alice Allen	Wildlife biologist
Jim Allen	Silviculturist
Neil Bosworth	Timber presale and planning forester
Les Gonyer	Hydrologist
Tom Gushue	GIS specialist
Rob Hoelscher	Wildlife biologist
Darcie Holst	Botanist
J. Hope Hornbeck	Botanist
Steve Keegan	Landscape architect
Elizabeth Krueger	Writer/editor
Glen Lewis	Fire and fuels specialist
Don Luhrsen	Range conservationist
Patti Lynch	Wildlife biologist
Dave McKee	Archeologist
Todd Mills	GIS specialist
Geri Proctor	Range conservationist
Rob Reeck	Timber presale and planning forester
Deanna Reyher	Soil conservationist
Rick Sorensen	Silviculturist
Jeanette Timm	Recreation and special uses forester
Ann Marie Verde	Engineering/travel management
Monte Williams	Hydrologist/GIS specialist

Support Team Members

Russ Bacon
Nancy Bayne
Darrol Birk
Don Boone
Keith Burden
Eric Carlson
Ed Fischer
Kelly Honors
Lou Howey
Lisa Lam
Peggy Livingston
Carl Owens
Randy Rick
Tom Silvey
Megan Timoney

Cooperators

Art Carter, South Dakota Department of Game, Fish and Parks
Don Ohlen, USGS, EROS Data Center
Gail Schmidt, USGS, EROS Data Center
Zhi-Liang Zhu, USGS, EROS Data Center